

VIII.—On some Earthworms from India and Palestine belonging to the British Museum. By J. STEPHENSON, M.B., D.Sc., Lecturer in Zoology, University of Edinburgh.

ON recently reading a paper by Mr. C. R. Narayan Rao, of the University of Mysore, on "The Anatomy of some new Species of *Drawida*," in the November number of this Magazine (Ann. & Mag. Nat. Hist. ser. 9, vol. viii. No. 47, Nov. 1921, p. 496), I was struck by the extraordinary characters of the worms; a number of their peculiarities seemed to be altogether irreconcilable with what we know of the anatomy of this genus, and I felt that I could not possibly admit Mr. Rao's species into the volume I am preparing on the Indian Oligochæta for the 'Fauna of British India' series without some corroboration of these anomalous features. I accordingly applied to the British Museum, where Mr. Rao has deposited his types, to have these sent to me. The Museum authorities very kindly sent me the worms, and I owe them my thanks for so promptly acceding to my request.

I find, as I had suspected, that Mr. Rao's accounts are in many respects incorrect, and especially so where they describe characters otherwise unknown in the genus. I take one of his worms—the first—as an example.

The specific name is spelt differently in his paper (*somavarpatana*) and on the label (*somvarpatana*); the place where it was taken is called Somavarpatana in the paper, Somvarpat on the label; the number of segments is given as 80-90, but the type-specimen has 124. The male pores are said to be large slits; I find them to be not slit-like, but puckered orifices with tumid lips. Unlike Mr. Rao, I was unable to distinguish externally the female and spermathecal pores; but from internal examination the spermathecal pores are considerably further from the middle line than is stated by him. The gizzards are (as always in the genus) segmental structures, and the three present in the type-specimen occupy segments xvi.-xviii. Mr. Rao, however, apparently thinks that the gizzards in this genus may take up more than one segment, and in this species, according to him, the three to five gizzards occupy segments xiv.-xxi.

Mr. Rao describes two pairs of sperm-sacs (such a character would at once remove the worm to another genus), the first pair suspended by septum 8/9 or connected with 8/9 (an unknown position for the sacs), while the second pair are said to "lie in somite x., having very early in development detached themselves from the septum 9/10."

There appears to be absolutely no warrant for this statement of what takes place in early development, and the condition so described would be totally without precedent. On examination there is found to be here, as always, only one pair of testes or sperm-sacs, attached to septum 9/10.

The prostate is said to be a comparatively small spherical structure. It is, in fact, a very large and conspicuous object, and is remarkable in being bifid. It would appear that Mr. Rao has mistaken these prostate glands for the "second pair of sperm-sacs."

There is an "ovarian chamber" (modified eleventh segment) which is not mentioned by Mr. Rao. It would be impossible in this genus for the egg-sacs to be suspended, as Mr. Rao says, from septum 10,11; the ovaries are throughout in segment xi. (or in a chamber which represents this segment narrowed and modified in form), and the ovisacs are posterior bulgings of septum 11/12 (or of the posterior wall of the chamber).

Mr. Rao gives lengthy descriptions of the microscopical structure of a number of the organs of this worm and of some of the others. The condition of the British Museum specimens, at any rate, does not seem to me to be such as to make detailed histological description advisable. Mr. Rao, however, describing certain glandular finger-shaped "alimentary appendages," gives an account, not easy to understand, of their development; certain muscular fibres of the gut-wall change their character and, becoming metamorphosed, give rise to the glandular processes, one process being derived from a single muscular fibre. The cells fringing the adult processes are compared to the solenocytes of *Polychaeta*; and there is said to be histological affinity between these enteric appendages of *Drawida* and the "enteronephridia" of *Pheretima*; indeed, diagrams are given to illustrate the evolution of septal nephridia from enteric appendages such as those of these worms—in this process of evolution the supra-intestinal blood-vessel becomes an excretory duct. The main function of the alimentary appendages is supposed to be that of storing water.

Without remarking on the numerous other structures which are described by Mr. Rao, I might perhaps mention that in the same species to which the above refers, the spermathecal atrium is figured as having an *outer* chitinous layer (*i. e.*, on its *peritoneal* surface), and is described in the text as having an outer tunic which is a thin cuticular layer.

Such extraordinary morphological ideas need not be seriously discussed. I do not think it is too much to say

that Mr. Rao's competence in morphological work is of the same degree of reliability as that which he shows in his systematic descriptions.

It is unnecessary to point out the errors in Mr. Rao's accounts of the four other species. They are of the same fundamental character as those I have noted above in his description of *D. somavarpatana*. Instead, it will, I think, be preferable simply to give short accounts of the worms themselves.

I may note that *D. scandens* is the same worm as one of which I have recently written a description, which is appearing in the 'Records of the Indian Museum.' under the name of *D. ravi*. Mr. Rao's name has the priority, and the name of *D. ravi* must be withdrawn.

I add to these descriptions an account of two species of earthworms which I received for identification some little time ago from the British Museum. These were collected by Mr. T. Aharoni; one species is already known, while the other appears to be new.

*Drawida sonavarpatana*, C. R. N. Rao.

Length 85 mm.; diameter in middle of body 4 mm. Segments 124. Colour brownish yellow. Prostomium small, retracted under segment i. No dorsal pores. Nephridiopores in the line of the lateral setæ.

Setæ closely paired;  $aa=bc$ ;  $dd=\frac{1}{2}$  circumference.

Clitellum apparently comprising segments x.-xiii. (= 4), but indistinct. The male pores are puckered orifices with tumid lips, situated a little outside the line of setæ *b*; in front of and behind each is a curved depression, the concavities facing each other, the anterior on segment x., the posterior on xi.; the mid-ventral regions of these two segments are depressed. The female and spermathecal apertures were not visible on external examination, but on dissection the spermathecal apertures were found to be in the line of the lateral setæ.

Septa 5/6-8/9 are slightly thickened. There are three gizzards (in the type-specimen), in segments xvi.-xviii., of which the last is the largest. A double series of white dendritic appendages are seen lying dorsally, segmentally arranged, on the intestine; these are somewhat reminiscent of the lymphatic glands of *Pheretima*, but the condition of specimens is too poor to allow of further examination. The last hearts are in segment ix.

The testis-sacs have the disposition which was described by Michaelsen in *D. ghatensis*; the main portion of the sacs occupies segment xiv., and is connected to septum 9/10

by a narrow neck. The prostates are of peculiar shape; each consists of two cylindrical or finger-shaped structures, which lie side by side and are slightly curled; these unite below, near the ventral body-wall, in a narrow neck, which again swells out somewhat at its termination, where it joins the parietes. The whole is a conspicuous object in segment x., on each side of the gut; the surface is soft, and a friable layer can easily be detached from the finger-shaped projections, disclosing a firm, shining, and evidently muscular axis, no doubt with a lumen in its centre. The junction of the vas deferens with the prostate was not seen.

There is a definite ovarian chamber, and the ovisacs are large, extending back to segment xiv.

The spermathecal ampulla is a somewhat ovoid sac. The duct forms a large coil projecting into segment viii.; the atrium is bifid, and consists of two horns of moderate size, one in segment vii. and one in viii., the duct joining in the angle between the two horns. The horns of the atrium are firm and shining; the exit to the surface is in the line of the lateral setæ.

There are strong transverse muscular bands on the inner surface of the body-wall in the prostatic region, to the contraction of which the depressions on the ventral surface of the genital region are doubtless due.

Somvarpat, 4000 ft., Coorg, S. India.

*Drawida scandens*, C. R. N. Rao.

Length 38-43 mm.; maximum diameter 1.75 mm., average 1.5 mm. Segments ca. 144-161. Colour brown, anterior end rather lighter. Prostomium prolobous. No dorsal pores. Nephridiopores not seen.

Setæ in anterior part of body very large for so small a worm, especially the ventral setæ from segment iv. backwards and the lateral from x.; *aa* is approximately equal to *bc*, and *dd* is rather more than half the circumference.

Clitellum not distinguishable. In groove 9/10 is a transversely elongated cushion, somewhat dumbbell-shaped and divided by a mid-ventral fissure into two; laterally this cushion extends to a point between the lines of setæ *b* and *c*, but nearer the line *c*. The ventral surface of segment xi. is thickened, and groove 10/11 is pushed forwards; the lateral extent of the thickening is about the same as that of the cushion in groove 9/10.

There are two pairs of male pores; one pair is on the cushion in 9/10, rather outside the line of setæ *b*; these belong to a second pair of prostates seen internally in segment ix. The other pair of male pores are near the antero-

lateral angles of the cushion of segment xi., also just outside the line of setæ *b*; since the groove 10/11 is pushed forwards by the thickened area, these pores occupy a position which would be in the groove if this had its normal position.

The female pores are possibly between the lines of *a* and *b* in groove 11/12. The spermathecal pores were not distinguishable externally; from internal examination they pierce the body-wall in line with the ventral setæ.

Septa 6/7-8/9 are somewhat thickened. There are three gizzards in segments xiii.-xv., and perhaps a rudimentary gizzard in addition in segment xii. The last hearts are in segment ix., but anteriorly in segment x. a large branch is given off on each side from the dorsal vessel, and passes obliquely downwards and backwards behind the testis-sac to the ventral body-wall.

The testis-sacs are one pair, projecting mostly into segment x. The prostates are upright sausage-shaped structures, slightly curved round the gut; their surface is soft; the vas deferens joins the prostate low down on its inner face, and can be seen to ascend for some distance on the gland. An exactly similar pair of prostates is present in segment ix.

The presence of an ovarian chamber is, in the type-specimen, doubtful on account of its condition. The ovisacs are finger-shaped, and extend back to segment xii. or xiii.

The spermathecal ampulla is small and subspherical. The atrium is large, ovoid, and sac-like, in segment vii.; its surface is soft, not muscular, and it narrows to its attachment to the body-wall in line with the ventral series of setæ; the duct joins the atrium near its base on the posterior side.

Bhagamandla, 4000 ft., Coorg, S. India.

*Drawida elegans*, C. R. N. Rao.

Length 130 mm.; diameter a little behind the middle 5 mm. Segments 206; viii.-xviii. bi- or triannular; the first two segments very short. Colour a nondescript grey, non-pigmented. Prostomium retractile, probolous. No dorsal pores. Nephridiopores in the line with the lateral setæ.

Setæ closely paired;  $aa = bc$ ;  $dd = \frac{1}{2}$  circumference.

Clitellum not definitely distinguishable. Male pores small, a little outside the line of setæ *b*. Female pores minute, in the line of *b*. Spermathecal pores just below the line of *c*.

Septa 5/6-8/9 exceptionally stout. Five gizzards, in segments xii.-xvi., the first rudimentary. Alimentary

appendages seem here to be an aggregate of vascular twigs. Last hearts in segment ix. One pair of nephridia per segment.

Testis-sacs moderately small, ovoidal, depending into segment x. The vas deferens is a very large coil, many times as bulky as the testis-sac itself, in segments ix. and x.; it then runs along the inner border of the prostate, which it enters near the ental end of the latter. The prostates are of moderate size, elongated, and lying backwards, somewhat compressed so as to approximate to a tongue-shape; there is no stalk, each being almost as thick at its attachment to the body-wall as elsewhere.

There is a complete ovarian chamber. The ovisacs are small, in segment xii.; their hinder end is much narrower, and is bent forwards or transversely.

The spermathecal ampulla is a small ovoid sac; the duct is much coiled, and lies on the posterior face of the septum; it pierces the septum low down, and mounts to enter the centre of the upper surface of the atrium. The atrium is large, much larger than the ampulla; it is shortly pear-shaped, with the narrower end on the body-wall; the upper end is depressed where the duct enters.

Bhagamandla, 4000 ft., Coorg, S. India.

*Drawida modesta*, C. R. N. Rao.

Length 75 mm.; diameter 4 mm. Segments ca. 207, very short, especially towards the hinder end. Colour brown. Prostomium? (destroyed). Dorsal pores absent. Nephridiopores apparently in line with setae *d*.

Setae closely paired;  $aa=bc$ ;  $dd=\frac{1}{2}$  circumference or slightly more.

Clitellum not established. The male area resembles that of *D. somarapatana*; the male pores have prominent anterior and posterior lips, and are themselves just outside the line of setae *b*. There are transverse groove-like depressions in front of and behind the pores, on segments x. and xi. respectively. The mid-ventral regions of segments x. and xi. are somewhat depressed.

Female pores?

Spermathecal pores slightly outside the lines of *b*; rather further outside than the male pores. A slightly elevated transversely oval flat papilla, brown in colour, is present just in front of each spermathecal aperture, taking up in longitudinal extent a length equal to two-fifths of the segment, and extending laterally from midway between the lines *a* and *b* to midway between the lines *b* and *c*.

Septa 5/6-8/9 thickened. There are two gizzards, in xii. and xiii.; there is, in addition, a slight thickening of

the œsophagus in xi. Some finger-shaped alimentary appendages are present. The last heart is in segment ix.

The testis-sacs are large, and project into segments ix. and x. The prostates are small, soft, transversely oval cushions, sessile on the body-wall; the vasa deferentia join their anterior borders.

An ovarian chamber appears to have been present, with the ovary on its anterior wall. The ovisacs extend back to segment xiii.

The spermathecal ampulla is somewhat polygonal from the pressure of surrounding parts. There is no visible atrium.

It is necessary to speak with some caution as to the internal anatomy of this species, as the single specimen has been much pulled about.

Moornad, Coorg, S. India.

*Drawida paradoxa*, C. R. N. Rao.

Length 90 mm.; average diameter 3 mm. Segments 152; segment i. is very small—a very narrow ring. Unpigmented, colour light grey. Prostomium prolobous. No dorsal pores. Nephridiopores not visible.

Setæ small, closely paired; *aa* in general = *bc*, but in the post-clitellar region =  $\frac{3}{4}bc$ ; *dd* is slightly less than  $\frac{1}{2}$  circumference.

Clitellum not visible. Male pores small, inconspicuous, just outside the line of *b*.

Female pores not visible.

Spermathecal pores small, in line with setæ *c*.

Septa 5/6-8/9 considerably thickened. Four gizzards, in segments xiii.-xvi., the first smallest, the last largest (in the second specimen the gizzards are in segments xii.-xv.; the first is rudimentary, the last largest). The last heart is in segment ix.

There is one pair of testis-sacs, of moderate size, sub-spherical in shape, depending into segment x. The vas deferens is a relatively very large coil, partly in segment ix. and partly in x.; it comes into relation with the prostate near the base of the latter, and can be traced some distance up its anterior border before it becomes lost in the soft furry prostatic investment. The prostates are of considerable size; the larger part of each is flattened from side to side, the edges being soft, opaque, and white, and the axial portion more shiny (in other words, the "glandular" investment of the muscular tube is confined to the anterior and posterior borders of the latter); the ectal portion of the prostate is a twisted mass, bound together by connected tissue and adherent to the ventral body-wall.

An ovarian chamber is present; the ovaries are prominent fringed projections on the anterior wall. The ovisacs are small projections into segment xii.

The spermathecal ampulla is small and subspherical; the duct is not much coiled. The atrium, in segment vii., is a large tongue-shaped structure, with a constriction a quarter or one-third of its length from the body-wall; the margins of the atrium are slightly lobed; the duct joins its lower portions.

Madapur, 3500 ft., Coorg.

*Helodrilus (Dendrobæa) samariger* (Rosa).

Huldah, Judæan Mountains; 5. iv. 1921 (*T. Aharoni*). A single specimen, mature. Called the "dew-worm." (234 B.M.)

*Helodrilus (Allolobophora) aharonii*, sp. n.

Rechoboth, Palestine. Three specimens, in poor condition (*T. Aharoni*). (219 B.M.)

The longest specimen is 105 mm. long and 4 mm. in diameter. Segments 141. Colour light brown, no difference between dorsal and ventral surfaces. Prostomium minute, tanylobous, with, however, a transverse groove across the tongue one-third of the way back. Dorsal pores exist from groove 6/7 backwards.

The setæ are very closely paired;  $aa = 1\frac{1}{2}bc$ ;  $dd$  is rather less than half the circumference.

The clitellum is not very distinct, but appears to take up nine segments, xxx.-xxxviii., with a "wall" which embraces segments xxxiii.-xxxvii. The male pores are indistinctly indicated as whitish thickenings on segment xv., between the lines of  $b$  and  $c$ . The ventral setæ of segments x., xi., and xii. are on whitish cushions.

Septum 5/6 is somewhat thickened, 6/7, 7/8, and 8/9 are much thickened, 9/10 and 10/11 somewhat so, and 11/12 slightly.

Calciferous glands are present in segments x., xi., and xii. The gizzard probably occupies segments xvii. and xviii., but the septa are so thinned as to be almost unrecognizable. The last hearts are in segment ix.

The male funnels are in segments x. and xi., and appear to be free (a delicate testis-sac would, however, in the condition of the specimens not have been distinctly recognizable). Seminal vesicles are present in segments ix., x., xi., and xii.; those in ix., xi., and xii. are large and only slightly lobed; those of segment x. are very much smaller. Spermathecae, small and spherical, are present in line with the lateral setæ, opening in 9/10 and 10/11.